

BRAILLE WORD RECOGNITION AS A FUNCTION OF
WORD LENGTH, FAMILIARITY, AND ORTHOGRAPHY

C. Y. Nolan and C. J. Kederis

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BRAILLE WORD RECOGNITION AS A FUNCTION OF WORD LENGTH, FAMILIARITY, AND ORTHOGRAPHY

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Braille is the medium for reading and writing by the blind. Its characters consist of the 63 possible combinations of embossed dots arranged in a two column, three row matrix as illustrated at the upper left of the handout. Some idea of the tactual and visual appearance of braille can be gained from the small sample attached to the back of the handout.

Braille, as commonly used in this country, is written in a complex code. Not only do the individual characters stand for letters of the alphabet, but according to usage, may stand for whole words or groups of letters within words. In addition, many words appear in standard abbreviated or contracted form. Examples of some of these usages are given in the handout.

Braille is read from left to right as the reader successively encounters the characters over a short temporal interval. Reading practices vary considerably among readers, and numerous combinations of hands, fingers, and techniques are employed. Part of this variability undoubtedly reflects the differences in methods used for teaching braille reading. Relatively few data are available on perceptual factors involved in braille reading. Techniques for teaching reading are apt to be based on teachers' ideas of what the process is like. These range from considering braille reading to be completely analogous to print reading to viewing it as a character-by-character process.

The present study is one of a series designed to provide a better understanding of the perceptual factors involved in tactual reading. Its specific goal is to compare recognition thresholds for braille words categorized in various combinations of word length, familiarity, and orthography. It was carried out with the support of the National Institutes of Health, Department of Health, Education, and Welfare.

The Method

The study employed a $2 \times 3 \times 3$ factorial design in which all treatments were administered to each subject. Therefore, the experimenters were able to isolate that part of the variance resulting from differences between subjects. The treatments were the following: (a) Word Length - which was varied to include words of 3, 5 and 7 characters; (b) Orthography - which was varied to include both fully spelled and contracted words; and (c) Familiarity - which was varied to include familiar, unfamiliar, and nonsense words. Familiarity was based on the frequency of the appearance of words in English print as determined by Thorndike (1932).

The task for each subject was to recognize the stimulus words as they were presented at increasing exposure times. The apparatus for this purpose was developed especially and is called a tachistotactometer. This device permits the controlled exposure of from 1-36 horizontally aligned braille characters for periods as short as .02 second and provides increments of .01 second for increasing exposure times.

Three words representing each possible combination of treatments were selected from Thorndike's Teachers Word Book of 20,000 Words. This resulted in a set of 54 stimulus words. The familiar words came from the most frequent 5000 words, while unfamiliar words were selected from the categories

above 10,000. All nonsense words were pronounceable. Since previous research by Kederis (1963) had shown that legibility of braille characters was affected by the number of dots, the number of dots in characters and words was held constant across the levels of orthography and familiarity. The stimulus words were arranged in 5 random orders which in turn were randomly ordered for each subject.

Initial exposure times for words were set at well below the recognition threshold and exposure times were increased in steps of .10 second until the subject had correctly identified each word. Incorrect responses prior to recognition were recorded verbatim. Four sessions of one hour each held on successive days were required for each subject.

The subjects used in the experiment were ten students from the Kentucky School for the Blind who had previously participated in a study of the legibility of Braille characters. They came from grades 5-12 and ranged in age from 9-20 years with the median age being 14. The study was conducted during the summer recess and the subjects were chosen principally on the basis of proximity to the school.

Results:

The principal data for each subject was the record of the exposure times at which each stimulus word was correctly identified. The subject score for any treatment combination was the mean recognition time for the three stimulus words in that category. Table 1, in the handout, gives the mean recognition threshold for all subjects for each treatment combination. Inspection of these means reveals that, generally, the means for each treatment variable increase in size as that variable becomes more complex. For example, recognition thresholds become greater as the number of characters in the braille words increases.

Table 2 in the handout gives the results of the analysis of the data. All main effects, i. e., familiarity, orthography, and word length are significant far beyond the 1% level of confidence. Further inspection of the table, however, reveals that all second order interactions except length x orthography and the third order interaction are significant at this same level. This, of course, means that the treatment effects are not simple but related in what appears to be a quite complex manner.

In some respects our findings for braille reading are similar to the results of early research on print reading. Cattell (1885, 1886) and Erdmann and Dodge (1898) and particularly Goldscheider and Muller (1893) found that whole familiar words are read more easily than unfamiliar words or unconnected letters. However at this point the similarity ceases. Research by these authors showed that words were read as wholes and found little difference in recognition times for words of different length, i. e., of four, eight, twelve, and fifteen letters. The longest words required only 20% more time for recognition than the shortest. Inspection of Table 1 in the handout shows that, even for uncontracted familiar braille words, increase in length from just 3 to 5 characters requires an increase of 74% in recognition time.

Another interesting finding in these early studies of print reading was that words of four letters are named more quickly than single letters. This does not appear to be the case for braille. Data (Kederis 1962) for recognition times of individual braille characters, based on similar subjects, were available for comparison with the results of the present study. The median recognition time for all braille characters was .04 second which is less than 1/10 the recognition time for words in the most readily recognized treatment category of this study. Even when the recognition thresholds

are summed for all the characters in the three character words, it is found that these sums are from 50% to 90% shorter than the recognition times for the words in which they are included.

Our findings indicate the possibility that the perceptual processes in braille reading may diverge appreciably from those of print reading. Particularly they throw doubt that braille words are read as wholes in the same fashion as print. Since the recognition times for braille words far exceed the sum of those for the characters included, it is possible that braille reading, at least in part, consists of a very rapid character by character integration.

Of course, these are only hints. However, it does appear that the method developed for studying braille reading is a fruitful one and that more comprehensive data of this kind, interpreted in the light of modern theories of communication, will lead to a much greater understanding of the perceptual factors involved in reading braille.

References:

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Braille Symbols

⠠ - Braille cell	⠠ - T, that	⠠ - wh, which
⠠ - I	⠠ - ar	⠠ - father
⠠ - O	⠠ - sh, shall	⠠ - world

Table 1

Mean Recognition Times in Seconds for Words Classified by Length (number of characters), Familiarity, and Orthography (uncontracted or contracted components).

		Number of Characters		
		<u>3</u>	<u>5</u>	<u>7</u>
Familiar	Uncontracted	.47	.82	1.22
	Contracted	.52	.86	1.33
Unfamiliar	Uncontracted	.76	1.26	1.57
	Contracted	.80	1.11	1.67
Nonsense	Uncontracted	.82	1.22	2.17
	Contracted	1.02	1.45	2.17

Table 2

Analysis of Recognition Times of Words Classified According to Length (C), Familiarity (F), and Orthography (O)

<u>Source</u>	<u>D F</u>	<u>M S</u>	<u>F</u>
F	2	5.477	47.63 *
F x S	18	.115	
C	2	13.899	57.43 *
C x S	18	.242	
O	1	.227	15.13 *
O x S	9	.015	
S	9	4.26	
F x C	4	.406	15.62 *
F x C x S	36	.026	
F x O	2	.081	7.36 *
F x O x S	18	.011	
C x O	2	.013	.72
C x O x S	18	.018	
F x C x O	4	.077	6.42 *
F x C x O x S	36	.012	

